



<110> Schroeder, Hartwig

<120> Process for preparing biotin

<130> 0000048792/UP

<140> US 09/622,419

<141> 2000- 08-16

<150> PCT/EP 99/01052

<151> 1999-02-17

<160> 17

<170> PatentIn Release 1.0, version 1.25 (EPO)/WordPerfect

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Asp Lys Ile Ala Asp Gln Ile Ser Asp Ala Val Leu Asp Ala Ile Leu
20 25 30

gaa cag gat ccg aaa gca cgc gtt gct tgc gaa acc tac gta aaa acc 144
Glu Gln Asp Pro Lys Ala Arg Val Ala Cys Glu Thr Tyr Val Lys Thr
35 40 45

ggc atg gtt tta gtt ggc ggc gaa atc acc acc agc gcc tgg gta gac 192
Gly Met Val Leu Val Gly Gly Glu Ile Thr Thr Ser Ala Trp Val Asp
50 55 60

atc gaa gag atc acc cgt aac acc gtt cgc gaa att ggc tat gtg cat 240
Ile Glu Glu Ile Thr Arg Asn Thr Val Arg Glu Ile Gly Tyr Val His
65 70 75 80

tcc gac atg ggc ttt gac gct aac tcc tgt gcg gtt ctg agc gct atc 288
Ser Asp Met Gly Phe Asp Ala Asn Ser Cys Ala Val Leu Ser Ala Ile
85 90 95

ggc aaa cag tct cct gac atc aac cag ggc gtt gac cgt gcc gat ccg 336
~~Gly Lys Gln Ser Pro Asp Ile Asn Gln Gly Val Asp Arg Ala Asp Pro~~
100 105 110

ctg gaa cag ggc gcg ggt gac cag ggt ctg atg ttt ggc tac gca act 384
Leu Glu Gln Gly Ala Gly Asp Gln Gly Leu Met Phe Gly Tyr Ala Thr
115 120 125

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ctg cgc ccg gac gcg aaa agc cag gtg act ttt cag tat gac gac ggc Leu Arg Pro Asp Ala Lys Ser Gln Val Thr Phe Gln Tyr Asp Asp Gly 165 170 175	528
aaa atc gtt ggt atc gat gct gtc gtg ctt tcc act cag cac tct gaa Lys Ile Val Gly Ile Asp Ala Val Leu Ser Thr Gln His Ser Glu 180 185 190	576
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aag cca att ctg ccc gct gaa tgg ctg act tct gcc acc aaa ttc ttc Lys Pro Ile Leu Pro Ala Glu Trp Leu Thr Ser Ala Thr Lys Phe Phe 210 215 220	672
atc aac ccg acc ggt cgt ttc gtt atc ggt ggc cca atg ggt gac tgc Ile Asn Pro Thr Gly Arg Phe Val Ile Gly Gly Pro Met Gly Asp Cys 225 230 235 240	720
ggt ctg act ggt cgt aaa att atc gtt gat acc tac ggc ggc atg gcg Gly Leu Thr Gly Arg Lys Ile Ile Val Asp Thr Tyr Gly Gly Met Ala 245 250 255	768
cgt cac ggt ggc ggt gca ttc tct ggt aaa gat cca tca aaa gtg gac Arg His Gly Gly Gly Ala Phe Ser Gly Lys Asp Pro Ser Lys Val Asp 260 265 270	816
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cgc cca tac ggt ctg att cag atg ctg gat ctg ctg cac ccg atc tac Arg Pro Tyr Gly Leu Ile Gln Met Leu Asp Leu Leu His Pro Ile Tyr 340 345 350	1056
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 Gly Met Val Leu Val Gly Gly Glu Ile Thr Thr Ser Ala Trp Val Asp
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 Ser Asp Met Gly Phe Asp Ala Asn Ser Cys Ala Val Leu Ser Ala Ile
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 Gly Lys Gln Ser Pro Asp Ile Asn Gln Gly Val Asp Arg Ala Asp Pro
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 Leu Arg Pro Asp Ala Lys Ser Gln Val Thr Phe Gln Tyr Asp Asp Gly
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 Lys Ile Val Gly Ile Asp Ala Val Val Leu Ser Thr Gln His Ser Glu
 180 185 190
 Glu Ile Asp Gln Lys Ser Leu Gln Glu Ala Val Met Glu Glu Ile Ile
 195 200 205

Lys Pro Ile Leu Pro Ala Glu Trp Leu Thr Ser Ala Thr Lys Phe Phe
 210 215 220
 Ile Asn Pro Thr Gly Arg Phe Val Ile Gly Gly Pro Met Gly Asp Cys
 225 230 235 240

Gly	Leu	Thr	Gly	Arg 245	Lys	Ile	Ile	Val	Asp 250	Thr	Tyr	Gly	Gly	Met 255	Ala
Arg	His	Gly	Gly 260	Gly	Ala	Phe	Ser	Gly 265	Lys	Asp	Pro	Ser	Lys 270	Val	Asp
Arg	Ser	Ala 275	Ala	Tyr	Ala	Ala	Arg 280	Tyr	Val	Ala	Lys	Asn 285	Ile	Val	Ala
Ala	Gly 290	Leu	Ala	Asp	Arg	Cys 295	Glu	Ile	Gln	Val	Ser 300	Tyr	Ala	Ile	Gly
Val 305	Ala	Glu	Pro	Thr	Ser 310	Ile	Met	Val	Glu	Thr 315	Phe	Gly	Thr	Glu	Lys 320
Val	Pro	Ser	Glu	Gln 325	Leu	Thr	Leu	Leu 330	Val	Arg	Glu	Phe	Phe	Asp 335	Leu
Arg	Pro	Tyr	Gly 340	Leu	Ile	Gln	Met	Leu 345	Asp	Leu	Leu	His	Pro 350	Ile	Tyr
Lys	Glu	Thr 355	Ala	Ala	Tyr	Gly	His 360	Phe	Gly	Arg	Glu	His 365	Phe	Pro	Trp
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Gln	Asp	Ala	Gly	Val	Tyr	Leu	Asp	Ser	Ala	Ala	Thr	Ala	Leu	Lys	Pro	
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Glu	Ala	Val	Val	Glu	Ala	Thr	Gln	Gln	Phe	Tyr	Ser	Leu	Ser	Ala	Gly	
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Asn	Val	His	Arg	Ser	Gln	Phe	Ala	Glu	Ala	Gln	Arg	Leu	Thr	Ala	Arg	
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tat	gaa	gct	gca	cga	gag	aaa	gtg	gcg	caa	tta	ctg	aat	gca	ccg	gat	240
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Val Ala Gln Cys Tyr Ala Arg Pro Arg Leu Gln Pro Gly Asp Glu Ile	100	105	110	
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Ile Val Ser Val Ala Glu His His Ala Asn Leu Val Pro Trp Leu Met	115	120	125	
gtc gcc caa caa act gga gcc aaa gtg gtg aaa ttg ccg ctt aat gcg				432
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Ala Met Ser Pro Trp Leu Gly Gly Gly Lys Met Val His Glu Val Ser	245	250	255	
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Phe Asp Gly Phe Thr Thr Gln Ser Ala Pro Trp Lys Leu Glu Ala Gly	260	265	270	
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Thr Pro Asn Val Ala Gly Val Ile Gly Leu Ser Ala Ala Leu Glu Trp	275	280	285	
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Leu Ala Asp Tyr Asp Ile Asn Gln Ala Glu Ser Trp Ser Arg Ser Leu	290	295	300	
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Phe Arg Cys Gln Asp Ser Ser Leu Leu Ala Phe Asp Phe Ala Gly Val	
325 330 335	
cat cat agc gat atg gtg acg ctg ctg gcg gag tac ggt att gcc ctg	1056
His His Ser Asp Met Val Thr Leu Leu Ala Glu Tyr Gly Ile Ala Leu	
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Arg Ala Gly Gln His Cys Ala Gln Pro Leu Leu Ala Glu Leu Gly Val	
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Thr Gly Thr Leu Arg Ala Ser Phe Ala Pro Tyr Asn Thr Lys Ser Asp	
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Tyr Glu Ala Ala Arg Glu Lys Val Ala Gln Leu Leu Asn Ala Pro Asp	
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Asp Lys Thr Ile Val Trp Thr Arg Gly Thr Thr Glu Ser Ile Asn Met	
85 90 95	
Val Ala Gln Cys Tyr Ala Arg Pro Arg Leu Gln Pro Gly Asp Glu Ile	
100 105 110	
Ile Val Ser Val Ala Glu His His Ala Asn Leu Val Pro Trp Leu Met	
115 120 125	

Val Ala Gln Gln Thr Gly Ala Lys Val Val Lys Leu Pro Leu Asn Ala
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 145 150 155 160
 Ser Arg Ile Leu Ala Leu Gly Gln Met Ser Asn Val Thr Gly Gly Cys
 165 170 175
 Pro Asp Leu Ala Arg Ala Ile Thr Phe Ala His Ser Ala Gly Met Val
 180 185 190
 Val Met Val Asp Gly Ala Gln Gly Ala Val His Phe Pro Ala Asp Val
 195 200 205
 Gln Gln Leu Asp Ile Asp Phe Tyr Ala Phe Ser Gly His Lys Leu Tyr
 210 215 220
 Gly Pro Thr Gly Ile Gly Val Leu Tyr Gly Lys Ser Glu Leu Leu Glu
 225 230 235 240
 Ala Met Ser Pro Trp Leu Gly Gly Gly Lys Met Val His Glu Val Ser
 245 250 255
 Phe Asp Gly Phe Thr Thr Gln Ser Ala Pro Trp Lys Leu Glu Ala Gly
 260 265 270
 Thr Pro Asn Val Ala Gly Val Ile Gly Leu Ser Ala Ala Leu Glu Trp
 275 280 285
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 325 330 335
 His His Ser Asp Met Val Thr Leu Leu Ala Glu Tyr Gly Ile Ala Leu
 340 345 350
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Pro Arg Val Ala Glu Lys Met Met Gln Phe Met Thr Met Asp Gly Thr	
20 25 30	
ttt ggt aac ccg gcc tcc cgt tct cac cgt ttc ggc tgg cag gct gaa	144
Phe Gly Asn Pro Ala Ser Arg Ser His Arg Phe Gly Trp Gln Ala Glu	
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gaa gcg gta gat atc gcc cgt aat cag att gcc gat ctg gtc ggc gct	192
Glu Ala Val Asp Ile Ala Arg Asn Gln Ile Ala Asp Leu Val Gly Ala	
50 55 60	
gat ccg cgt gaa atc gtc ttt acc tct ggt gca acc gaa tct gac aac	240
Asp Pro Arg Glu Ile Val Phe Thr Ser Gly Ala Thr Glu Ser Asp Asn	
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Leu Ala Ile Lys Gly Ala Ala Asn Phe Tyr Gln Lys Lys Gly Lys His	
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Ile Ile Thr Ser Lys Thr Glu His Lys Ala Val Leu Asp Thr Cys Arg	
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cag ctg gag cgc gaa ggt ttt gaa gtc acc tac ctg gca ccg cag cgt	384
Gln Leu Glu Arg Glu Gly Phe Glu Val Thr Tyr Leu Ala Pro Gln Arg	
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Thr Ile Leu Val Ser Ile Met His Val Asn Asn Glu Ile Gly Val Val	
145 150 155 160	
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Gln Asp Ile Ala Ile Gly Glu Met Cys Arg Ala Arg Gly Ile Ile	
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tat cac gtt gat gca acc cag agc gtg ggt aaa ctg cct atc gac ctg	576
Tyr His Val Asp Ala Thr Gln Ser Val Gly Lys Leu Pro Ile Asp Leu	
180 185 190	
agc cag ttg aaa gtt gac ctg atg tct ttc tcc ggt cac aaa atc tat	624
Ser Gln Leu Lys Val Asp Leu Met Ser Phe Ser Gly His Lys Ile Tyr	
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Arg	Ile	Ala	Lys	Glu	Glu	Met	Ala	Thr	Glu	Met	Glu	Arg	Leu	Arg	Gly	260	265	270	
Leu	Arg	Asn	Arg	Leu	Trp	Asn	Gly	Ile	Lys	Asp	Ile	Glu	Glu	Val	Tyr	275	280	285	
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 Thr Ile Glu Leu Val Arg Lys Ser Ile Gly Arg Leu Arg Asp Leu Ser
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Ala Gln Lys Pro Ser Gln Val Ile Asp Ala Glu Ala Glu Phe Tyr Arg	
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His Gly Tyr Ala Ala Val His Arg Gly Ile His Thr Leu Ser Ala Gln	
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<400> 12

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 35 40 45

Asn Val His Arg Ser Gln Phe Ala Glu Ala Gln Arg Leu Thr Ala Arg
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Tyr Glu Ala Ala Arg Glu Lys Val Ala Gln Leu Leu Asn Ala Pro Asp
 65 70 75 80

Asp Lys Thr Ile Val Trp Thr Arg Gly Thr Thr Glu Ser Ile Asn Met
 85 90 95

Val Ala Gln Cys Tyr Ala Arg Pro Arg Leu Gln Pro Gly Asp Glu Ile
 100 105 110

Ile Val Ser Val Ala Glu His His Ala Asn Leu Val Pro Trp Leu Met
 115 120 125

Val Ala Gln Gln Thr Gly Ala Lys Val Val Lys Leu Pro Leu Asn Ala
 130 135 140

Gln Arg Leu Pro Asp Val Asp Leu Leu Pro Glu Leu Ile Thr Pro Arg
 145 150 155 160

Ser Arg Ile Leu Ala Leu Gly Gln Met Ser Asn Val Thr Gly Gly Cys
 165 170 175

Pro Asp Leu Ala Arg Ala Ile Thr Phe Ala His Ser Ala Gly Met Val
 180 185 190

Val Met Val Asp Gly Ala Gln Gly Ala Val His Phe Pro Ala Asp Val
 195 200 205

Gln Gln Leu Asp Ile Asp Phe Tyr Ala Phe Ser Gly His Lys Leu Tyr
 210 215 220

Gly Pro Thr Gly Ile Gly Val Leu Tyr Gly Lys Ser Glu Leu Leu Glu
 225 230 235 240

Ala Met Ser Pro Trp Leu Gly Gly Gly Lys Met Val His Glu Val Ser
 245 250 255

Phe Asp Gly Phe Thr Thr Gln Ser Ala Pro Trp Lys Leu Glu Ala Gly
 260 265 270

Thr Pro Asn Val Ala Gly Val Ile Gly Leu Ser Ala Ala Leu Glu Trp

275	280	285
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Ala Thr Leu Ala Glu Asp Ala Leu Ala Lys Arg Pro Gly Phe Arg Ser		
305	310	315 320
Phe Arg Cys Gln Asp Ser Ser Leu Leu Ala Phe Asp Phe Ala Gly Val		
	325	330 335
His His Ser Asp Met Val Thr Leu Leu Ala Glu Tyr Gly Ile Ala Leu		
	340	345 350
Arg Ala Gly Gln His Cys Ala Gln Pro Leu Leu Ala Glu Leu Gly Val		
	355	360 365
Thr Gly Thr Leu Arg Ala Ser Phe Ala Pro Tyr Asn Thr Lys Ser Asp		
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<400> 13

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aacagctacg gaactcttgt gcgtaaggaa aagtaaggaa aacgattcct tctaacagaa	360
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Met Ala	
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Lys His Leu Phe Thr Ser Glu Ser Val Ser Glu Gly His Pro Asp Lys	
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Ile Ala Asp Gln Ile Ser Asp Ala Val Leu Asp Ala Ile Leu Glu Gln	
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Asp Pro Lys Ala Arg Val Ala Cys Glu Thr Tyr Val Lys Thr Gly Met	
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Val Leu Val Gly Gly Glu Ile Thr Thr Ser Ala Trp Val Asp Ile Glu	
55 60 65	
gag atc acc cgt aac acc gtt cgc gaa att ggc tat gtg cat tcc gac	775
Glu Ile Thr Arg Asn Thr Val Arg Glu Ile Gly Tyr Val His Ser Asp	
70 75 80	
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Met Gly Phe Asp Ala Asn Ser Cys Ala Val Leu Ser Ala Ile Gly Lys	
85 90 95	
cag tct cct gac atc aac cag ggc gtt gac cgt gcc gat ccg ctg gaa	871
Gln Ser Pro Asp Ile Asn Gln Gly Val Asp Arg Ala Asp Pro Leu Glu	
100 105 110	
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Gln Gly Ala Gly Asp Gln Gly Leu Met Phe Gly Tyr Ala Thr Asn Glu	
115 120 125 130	
acc gac gtg ctg atg cca gca cct atc acc tat gca cac cgt ctg gta	967
Thr Asp Val Leu Met Pro Ala Pro Ile Thr Tyr Ala His Arg Leu Val	
135 140 145	
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Gln Arg Gln Ala Glu Val Arg Lys Asn Gly Thr Leu Pro Trp Leu Arg	
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Pro Asp Ala Lys Ser Gln Val Thr Phe Gln Tyr Asp Asp Gly Lys Ile	
165 170 175	
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Val Gly Ile Asp Ala Val Val Leu Ser Thr Gln His Ser Glu Glu Ile	
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Asp Gln Lys Ser Leu Gln Glu Ala Val Met Glu Glu Ile Ile Lys Pro	
195 200 205 210	
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Ile Leu Pro Ala Glu Trp Leu Thr Ser Ala Thr Lys Phe Phe Ile Asn	
215 220 225	

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Pro Thr Gly Arg Phe Val Ile Gly Gly Pro Met Gly Asp Cys Gly Leu	
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act ggt cgt aaa att atc gtt gat acc tac ggc ggc atg gcg cgt cac	1303
Thr Gly Arg Lys Ile Ile Val Asp Thr Tyr Gly Gly Met Ala Arg His	
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Gly Gly Gly Ala Phe Ser Gly Lys Asp Pro Ser Lys Val Asp Arg Ser	
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Ala Ala Tyr Ala Ala Arg Tyr Val Ala Lys Asn Ile Val Ala Ala Gly	
275 280 285 290	
ctg gcc gat cgt tgt gaa att cag gtt tcc tac gca atc ggc gtg gct	1447
Leu Ala Asp Arg Cys Glu Ile Gln Val Ser Tyr Ala Ile Gly Val Ala	
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Glu Pro Thr Ser Ile Met Val Glu Thr Phe Gly Thr Glu Lys Val Pro	
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Ser Glu Gln Leu Thr Leu Leu Val Arg Glu Phe Phe Asp Leu Arg Pro	
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Tyr Gly Leu Ile Gln Met Leu Asp Leu Leu His Pro Ile Tyr Lys Glu	
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Thr Ala Ala Tyr Gly His Phe Gly Arg Glu His Phe Pro Trp Glu Lys	
355 360 365 370	
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Ser Ala Ala Thr Ala Leu Lys Pro Glu Ala Val Val Glu Ala Thr Gln	
410 415 420	
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Gln Phe Tyr Ser Leu Ser Ala Gly Asn Val His Arg Ser Gln Phe Ala	
425 430 435 440	
gaa gcc caa cgc ctg acc gcg cgt tat gaa gct gca cga gag aaa gtg	1997

Glu	Ala	Gln	Arg	Leu	Thr	Ala	Arg	Tyr	Glu	Ala	Ala	Arg	Glu	Lys	Val	
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gcg	caa	tta	ctg	aat	gca	ccg	gat	gat	aaa	act	atc	gtc	tgg	acg	cgc	2045
Ala	Gln	Leu	Leu	Asn	Ala	Pro	Asp	Asp	Lys	Thr	Ile	Val	Trp	Thr	Arg	
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ggc	acc	act	gaa	tcc	atc	aac	atg	gtg	gca	caa	tgc	tat	gcg	cgt	ccg	2093
Gly	Thr	Thr	Glu	Ser	Ile	Asn	Met	Val	Ala	Gln	Cys	Tyr	Ala	Arg	Pro	
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cgt	ctg	caa	ccg	ggc	gat	gag	att	att	gtc	agc	gtg	gca	gaa	cac	cac	2141
Arg	Leu	Gln	Pro	Gly	Asp	Glu	Ile	Ile	Val	Ser	Val	Ala	Glu	His	His	
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gcc	aac	ctc	gtc	ccc	tgg	ctg	atg	gtc	gcc	caa	caa	act	gga	gcc	aaa	2189
Ala	Asn	Leu	Val	Pro	Trp	Leu	Met	Val	Ala	Gln	Gln	Thr	Gly	Ala	Lys	
505					510				515						520	
gtg	gtg	aaa	ttg	ccg	ctt	aat	gcg	cag	cga	ctg	ccg	gat	gtc	gat	ttg	2237
Val	Val	Lys	Leu	Pro	Leu	Asn	Ala	Gln	Arg	Leu	Pro	Asp	Val	Asp	Leu	
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Leu	Pro	Glu	Leu	Ile	Thr	Pro	Arg	Ser	Arg	Ile	Leu	Ala	Leu	Gly	Gln	
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Phe	Ala	His	Ser	Ala	Gly	Met	Val	Val	Met	Val	Asp	Gly	Ala	Gln	Gly	
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Ala	Val	His	Phe	Pro	Ala	Asp	Val	Gln	Gln	Leu	Asp	Ile	Asp	Phe	Tyr	
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gct	ttt	tca	ggt	cac	aaa	ctg	tat	ggc	ccg	aca	ggt	atc	ggc	gtg	ctg	2477
Ala	Phe	Ser	Gly	His	Lys	Leu	Tyr	Gly	Pro	Thr	Gly	Ile	Gly	Val	Leu	
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tat	ggt	aaa	tca	gaa	ctg	ctg	gag	gcg	atg	tcg	ccc	tgg	ctg	ggc	ggc	2525
Tyr	Gly	Lys	Ser	Glu	Leu	Leu	Glu	Ala	Met	Ser	Pro	Trp	Leu	Gly	Gly	
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ggc	aaa	atg	ggt	cac	gaa	gtg	agt	ttt	gac	ggc	ttc	acg	act	caa	tct	2573
Gly	Lys	Met	Val	His	Glu	Val	Ser	Phe	Asp	Gly	Phe	Thr	Thr	Gln	Ser	
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gcg	ccg	tgg	aaa	ctg	gaa	gct	gga	acg	cca	aat	gtc	gct	ggt	gtc	ata	2621
Ala	Pro	Trp	Lys	Leu	Glu	Ala	Gly	Thr	Pro	Asn	Val	Ala	Gly	Val	Ile	
	650					655					660					
gga	tta	agc	gcg	gcg	ctg	gaa	tgg	ctg	gca	gat	tac	gat	atc	aac	cag	2669
Gly	Leu	Ser	Ala	Ala	Leu	Glu	Trp	Leu	Ala	Asp	Tyr	Asp	Ile	Asn	Gln	
665					670				675						680	

gcc gaa agc tgg agc cgt agc tta gca acg ctg gcg gaa gat gcg ctg Ala Glu Ser Trp Ser Arg Ser Leu Ala Thr Leu Ala Glu Asp Ala Leu 685 690 695	2717
gcg aaa cgt ccc ggc ttt cgt tca ttc cgc tgc cag gat tcc agc ctg Ala Lys Arg Pro Gly Phe Arg Ser Phe Arg Cys Gln Asp Ser Ser Leu 700 705 710	2765
ctg gcc ttt gat ttt gct ggc gtt cat cat agc gat atg gtg acg ctg Leu Ala Phe Asp Phe Ala Gly Val His His Ser Asp Met Val Thr Leu 715 720 725	2813
ctg gcg gag tac ggt att gcc ctg cgg gcc ggg cag cat tgc gct cag Leu Ala Glu Tyr Gly Ile Ala Leu Arg Ala Gly Gln His Cys Ala Gln 730 735 740	2861
ccg cta ctg gca gaa tta ggc gta acc ggc aca ctg cgc gcc tct ttt Pro Leu Leu Ala Glu Leu Gly Val Thr Gly Thr Leu Arg Ala Ser Phe 745 750 755 760	2909
gcg cca tat aat aca aag agt gat gtg gat gcg ctg gtg aat gcc gtt Ala Pro Tyr Asn Thr Lys Ser Asp Val Asp Ala Leu Val Asn Ala Val 765 770 775	2957
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<211> 384

<212> PRT

<213> Escherichia coli

<400> 14

Met Ala Lys His Leu Phe Thr Ser Glu Ser Val Ser Glu Gly His Pro
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Glu Gln Asp Pro Lys Ala Arg Val Ala Cys Glu Thr Tyr Val Lys Thr
 35 40 45

Gly Met Val Leu Val Gly Gly Glu Ile Thr Thr Ser Ala Trp Val Asp
 50 55 60

Ile Glu Glu Ile Thr Arg Asn Thr Val Arg Glu Ile Gly Tyr Val His
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Ser Asp Met Gly Phe Asp Ala Asn Ser Cys Ala Val Leu Ser Ala Ile

<210> 15
 <211> 401
 <212> PRT
 <213> Escherichia coli

<400> 15

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Glu	Ala	Val	Val	Glu	Ala	Thr	Gln	Gln	Phe	Tyr	Ser	Leu	Ser	Ala	Gly	35	40	45	
Asn	Val	His	Arg	Ser	Gln	Phe	Ala	Glu	Ala	Gln	Arg	Leu	Thr	Ala	Arg	50	55	60	
Tyr	Glu	Ala	Ala	Arg	Glu	Lys	Val	Ala	Gln	Leu	Leu	Asn	Ala	Pro	Asp	65	70	75	80
Asp	Lys	Thr	Ile	Val	Trp	Thr	Arg	Gly	Thr	Thr	Glu	Ser	Ile	Asn	Met	85	90	95	
Val	Ala	Gln	Cys	Tyr	Ala	Arg	Pro	Arg	Leu	Gln	Pro	Gly	Asp	Glu	Ile	100	105	110	
Ile	Val	Ser	Val	Ala	Glu	His	His	Ala	Asn	Leu	Val	Pro	Trp	Leu	Met	115	120	125	
Val	Ala	Gln	Gln	Thr	Gly	Ala	Lys	Val	Val	Lys	Leu	Pro	Leu	Asn	Ala	130	135	140	
Gln	Arg	Leu	Pro	Asp	Val	Asp	Leu	Leu	Pro	Glu	Leu	Ile	Thr	Pro	Arg	145	150	155	160
Ser	Arg	Ile	Leu	Ala	Leu	Gly	Gln	Met	Ser	Asn	Val	Thr	Gly	Gly	Cys	165	170	175	
Pro	Asp	Leu	Ala	Arg	Ala	Ile	Thr	Phe	Ala	His	Ser	Ala	Gly	Met	Val	180	185	190	
Val	Met	Val	Asp	Gly	Ala	Gln	Gly	Ala	Val	His	Phe	Pro	Ala	Asp	Val	195	200	205	
Gln	Gln	Leu	Asp	Ile	Asp	Phe	Tyr	Ala	Phe	Ser	Gly	His	Lys	Leu	Tyr	210	215	220	
Gly	Pro	Thr	Gly	Ile	Gly	Val	Leu	Tyr	Gly	Lys	Ser	Glu	Leu	Leu	Glu	225	230	235	240
Ala	Met	Ser	Pro	Trp	Leu	Gly	Gly	Gly	Lys	Met	Val	His	Glu	Val	Ser	245	250	255	
Phe	Asp	Gly	Phe	Thr	Thr	Gln	Ser	Ala	Pro	Trp	Lys	Leu	Glu	Ala	Gly	260	265	270	

Thr Pro Asn Val Ala Gly Val Ile Gly Leu Ser Ala Ala Leu Glu Trp
 275 280 285

Leu Ala Asp Tyr Asp Ile Asn Gln Ala Glu Ser Trp Ser Arg Ser Leu
 290 295 300

Ala Thr Leu Ala Glu Asp Ala Leu Ala Lys Arg Pro Gly Phe Arg Ser
 305 310 315 320

Phe Arg Cys Gln Asp Ser Ser Leu Leu Ala Phe Asp Phe Ala Gly Val
 325 330 335

His His Ser Asp Met Val Thr Leu Leu Ala Glu Tyr Gly Ile Ala Leu
 340 345 350

Arg Ala Gly Gln His Cys Ala Gln Pro Leu Leu Ala Glu Leu Gly Val
 355 360 365

Thr Gly Thr Leu Arg Ala Ser Phe Ala Pro Tyr Asn Thr Lys Ser Asp
 370 375 380

Val Asp Ala Leu Val Asn Ala Val Asp Arg Ala Leu Glu Leu Leu Val
 385 390 395 400

Asp

<210> 16
 <211> 32
 <212> DNA
 <213> Artificial Sequence

<220>
 <223> PCR primer

<400> 16

gcgggtaccag gtgatattaa atatggcaaa ac

32

<210> 17
 <211> 28
 <212> DNA
 <213> Artificial Sequence

<220>
 <223> PCR primer

<400> 17

cgggtaccga ttacttcaga ccggcagc

28